A SEATING UNIT

This invention relates to a seating unit. More specifically the invention relates to an aircraft seating unit.

In our International patent application (Publication No. WO 96/18537) there is described a seating unit which comprises a primary seat and a secondary unit. The seating unit can be easily manipulated from a "seating configuration" wherein the primary seat functions as a seat to a "bed configuration" wherein the primary seat co-operates with the secondary unit to form a flat sleeping surface. For increased passenger privacy each seating unit is contained within its own fixed housing.

The seats described in WO 96/18537 are currently being used in our first class cabins. The ease of manipulation of each seating unit from a "seat configuration" to a "bed configuration" within a fixed housing, and also the staggered arrangement of the units helps provide a level of comfort and privacy which has set an industry benchmark. In most aircraft the business class cabin is fitted with large reasonably spaced apart seats. However, such seats are not designed to lie flat and do not provide passengers with as much privacy as they would ideally prefer. Despite their success in first class cabins the seating units described in WO 96/18537 are not well suited for use in business class cabins. This is because fitting such seats in a business cabin would mean having to reduce the overall seating capacity of the cabin to an uneconomical level.

It is therefore desirable to provide a seating unit suitable for use in an aircraft cabin, the unit being private and comfortable and making efficient use of the space available in the cabin.

According to the invention there is provided a seating unit for a vehicle the seating unit comprising a pair of seats facing in opposite directions with each seat comprising a seating space for receiving the seated body of an occupant and an extension space in which the legs of an occupant may be

placed, the seats being positioned each side of a notional dividing axis with the seating space of one extending over the axis at the extension space of the other.

According to another aspect of the invention there is provided a pair of seats, one for facing forward and the other for facing aft when fitted in an aircraft, each seat defining a major occupancy area and a minor occupancy area extending away from the major occupancy area along a seat axis and comprising a wall to one side of the major occupancy area, the seats being positioned adjacent to each other such that the walls of the seats share a common axis offset with respect to the seat axes to define a major occupancy area in one of the seat which is larger than the minor occupancy area in the other of the seats.

According to another aspect of the invention there is provided a seat for use in an aircraft cabin, the seat comprising a back pan and a seat pan operable together to a plurality of different positions including a take-off position at which the seat pan is inclined to the floor of the cabin to compensate for the take off angle of the aircraft.

According to another aspect of the invention there is provided a secondary unit for use in an aircraft cabin with an aircraft seat, the unit comprising: a pad mounted on an elongate support, the support being of variable height, whereby the elevation of the pad above the cabin floor can be altered.

According to another aspect of the invention there is provided a seating unit for an aircraft cabin, the unit comprising; a seat movable between a retracted position and an extended position; a footrest that is movable into and out of alignment with the seat; and a footrest actuator arranged to move the footrest into alignment with the seat, when the seat is moved towards the extended position.

According to another aspect of the invention there is provided an in-flight entertainment unit comprising: a housing; a monitor supported on the housing by a support arm, the support arm being rotatable about the housing to move the monitor between a stored position and a viewing position and the monitor being rotatable about the support arm to vary a viewing angle when in the viewing position.

According to another aspect of the invention there is provided an in-flight entertainment unit comprising in a self-contained unit which facilitates maintenance of the unit two or more of the following, namely: a monitor; a computer power point; a cocktail table; a condition indicator; or an audio output jack.

The above and further features of the invention are set forth with particularity in the appended claims and together with advantages thereof will become clearer from consideration of the following detailed description of an exemplary embodiment of the invention given with reference to the accompanying drawings.

In the drawings:

Figure 1 shows a side view of a pair of seats embodying the invention;

Figure 2 shows a side view of a pair of seats embodying the invention;

Figure 3 shows a plan view of a pair of seats embodying the invention;

Figure 4 shows a plan view of a pair of housings for the seats shown in Figures 1 to 3;

Figures 5a to 5c show an in-flight entertainment unit;

Figures 6a to 6e show a side view pair of a pair of multimode seats;

Figure 7a shows a perspective view of a secondary unit;

Figure 7b shows a secondary unit in an upright configuration;

Figure 7c shows a secondary unit having a pad in a lowered configuration;

Figure 7d shows a secondary unit having a pad in a stored configuration;

Figure 7e shows a plan view of a secondary unit;

Figure 8 shows a plan view of a pair of seats embodying the invention;

Figure 9 shows a plan view of a seating portion approaching a misaligned secondary unit;

Figure 10 shows a side view in partial cut-away of a secondary unit;

Figure 11 shows an arrangement of seats in an aircraft cabin;

Referring now to Figures 1 to 3 of the accompanying drawings there is shown a pair of seating units 1 for an aircraft. The pair of seats 1 is mounted on a pallet to facilitate fitting of the pair in an aircraft cabin. Such pallets are known in the art and therefore need not be described further herein. The pair of seating units 1 are in side-by-side arrangement, with a first seating unit 2a for facing towards the front of the aircraft cabin and a second seating unit 2b facing towards the rear of the aircraft cabin. Each of the first and second seating units 2a and 2b comprises a primary reclinable seat 4a, 4b which faces a secondary unit 5a, 5b. During a flight, a passenger can recline in comfort on a primary seat 4 whilst resting his or her feet on the corresponding secondary unit 5.

The primary seat 4a is contained in a first housing 6, within which the primary seat 4a can recline. The primary seat 4b is contained within a second housing 16 within which it can recline. The first housing 6 and the second housing 16 provide privacy between the two primary seats 4a and 4b.

In many respects the two seating units are substantially identical. In order to simplify the following description, reference will be made to the features and operation of a single seating unit except where there are differences between the two.

Each primary seat 4 comprises a back portion 7 pivotally connected to a seating portion 8. The seating portion 8 is supported on the cabin floor by a trolley 9 which is drivable, under the control of a respective control pad 3, by a motor operated screw shaft 9a. Driving of the trolley 9 serves to move the primary seat 4 between an upright position, as shown in Figure 1, to a bed position, as shown in Figure 2. In the bed position, the secondary unit 5 together with the seat portion 8 and back portion 7 of the primary seat 4 form a sleeping surface. Also, in this bed position the back portion 7 is supported by a support 17 in the housing. The movement of the seating portion 8 and the back portion 7 between the upright and bed positions is guided by suitable guide tracks (not shown) contained in the housing 6 or 16 at each side of the primary seat 4. Such guide tracks are well known in the art and are described in greater detail in the aforementioned international patent publication WO 96/18537.

The first housing 6 and the second housing 16 are most clearly shown in plan view in Figure 4. For improved clarity the primary seats 4 and secondary units 5 are not shown in Figure 4. The first housing 6 comprises a first side wall 6a, a second side wall 6b, and a curved back wall 6c which together define a space within which the seating unit 2a (not shown) is contained.

The first side wall 6a, the second side wall 6b and the back wall 6c are preferably separate structures and are assembled together by clipping the back wall 6c to each of the first 6a and second 6b side walls. The second housing 16 is similar in design to the first housing 6 and comprises its own first side wall 16a, second side wall 16b and curved back wall 16c respectively.

In the side-by-side arrangement in which the seating units are placed the first side wall 6a and the first side wall 16a are adjacent to each other. Thus, the first housing 6 and the second housing 16 together form in plan view a distorted S shape. Arm rests 10a and 10b are provided on the first side

walls 6a, 16a and second side walls 6b, 16b. This arrangement simplifies the maintenance of components of the seating unit, because access to the components which would otherwise be difficult, can be gained by unclipping and removing a back wall from its housing.

The first side wall 6a of the first housing 6 and the first side wall 16a of the second housing 16 both extend along an axis A-A which axis is offset with respect to the longitudinal axis B-B of the pair of seating units. The second side walls 6b and 16b of the housings 6 and 16 extend along an axis which is substantially parallel to the longitudinal axis of the pair of seating units. The space defined by the housings, 6, 16 are therefore less at the secondary units 5 than at the back walls 6c and 16c. The first housing 6 can therefore be thought of as defining a major occupancy area Xa for the upper part of one occupant and a minor occupancy area Ya for the lower part of the one occupant. Similarly the second housing 16 can be thought of as defining a major occupancy area Xb for the upper part of another occupant and a minor occupancy area Yb for the lower part of the other occupant.

In this configuration, the seating units can be thought of as being positioned each side of a notional dividing line corresponding to the longitudinal axis B-B of the pair of seating units. The housings 6 and 16 are shaped so that the major occupancy area Xa of the first seating unit 2a extends over the dividing line B-B at the minor occupancy area Yb of the second seating unit 2b and so that the major occupancy area Xb of the second seating unit 2b extends over the dividing line B-B at the minor occupancy area Ya of the first seating unit 2a. Thus, extra space is provided where it is needed for the upper body of a passenger and less space, where it is not needed, for the legs. Enough space is made available for each of the seating units to be provided with the arm rests 10a, 10b with the arm rests 10a arranged along a common axis.

Conveniently, each seating unit is also provided with storage space located underneath the primary seat of the adjacent seating unit and accessible via a hatch 18a (see Figure 1). The storage space may be used to store personal belongings of a passenger, or safety equipment such as a lifejacket. Additional storage space may be provided within each of the trolleys that support a seating portion. A recess 18b and a literature pocket 18c are also provided above the storage hatch 18a.

To provide privacy between the two seating units 2a and 2b the seating unit 2a is provided with a petal or blade-like privacy screen 11a and the seating unit 2b is provided with a corresponding privacy screen 11b (see Figures 1 and 2). The privacy screen 11a is pivoted to the first side wall 6a of the housing 6 at a pivot point 12. The privacy screen 11b is similarly pivoted at a pivot point (not shown) to the second housing 16. Each privacy screen 11a, 11b dissects the common axis of the first arm rests 10a and is rotatable about its respective pivot point in a plane defined by the respective first side wall 6a, 16a. The sense of rotation of the privacy screens 11a, 11b is indicated by the arrows D-D and E-E respectively in Figure 1.

Ideally, each of the privacy screens 11a and 11b is rotatable to block eye-to-eye contact between adjacent passengers when either of the seating units is in any configuration between fully upright and fully reclined positions. Each privacy screen can be fixed in a desired position by a suitable détente mechanism (not shown). Of course, should adjacent passengers wish to converse with each other, then the privacy screens 11a, 11b can be suitably positioned to allow eye contact between the passengers.

Preferably, each of the privacy screens 11a and 11b is composed of a lightweight flexible material so that in the event of an emergency, the screen can be easily rotated out of the way, or if necessary pushed to one side, to allow access to oxygen masks released from overhead compartments. One

known material having these properties from which a privacy screen may be constructed is Tufnol(RTM).

As is shown in Figure 3 of the accompanying drawings, the first seating unit 2a is provided with a one-piece table 13 which is positionable to extend across the seating unit 2a over the lap of a passenger (not shown). The table 13 is stored in a known manner in the arm rest 10b. The table 13 is pivotally mounted to the arm rest 10b of the seating unit 2a by a knuckle joint (not shown). To deploy the table 13 from the stored position the table 13 is first rotated in the plane of the arm 10 out of the storage area and then rotated down over the passenger's lap. When deployed, the joint connecting the table to the arm rest allows the table to be slid perpendicular to the arm 10, in a fore and aft direction (indicated by the arrows F-F) to a position at which the passenger is comfortable. The table 13 can also be rotated in a plane parallel to that of the cabin floor between the position in which the table 13 extends across the seat (shown in full lines), to a position (shown in broken lines) in which the table 13 extends parallel to the axis of the seat. This allows for easy access to and from the seat without a passenger having to return the table 13 to the storage area.

The table 13 includes at one end a fin-shaped projection 14 shaped and positioned to rest on the arm rest 9 of the seating unit 2a when the table 13 extends across the seating unit 2a. Preferably, the projection 12a is made of a resilient material so that when the table 13 supports a load, and the projection 14 rests on the arm rest 10a the arm rest 10a is not damaged.

Traditionally, in-flight entertainment devices, such as display screens, headphone points and the like have been mounted to the arm rests of aircraft seats. Accommodating such devices at arm rests has resulted in arm rests that are wider than would be otherwise necessary just to support the arms of an occupant. This is an inefficient use of space. Each of the seating units 2a and 2b is therefore provided with a self-contained in-flight entertainment unit 15a

and 15b respectively, each of which is positioned in front of its corresponding primary seat 4 and fixed to the housing of the adjacent seating unit. Such an entertainment unit, is shown in detail in Figures 5a to 5c, comprises a housing 20 containing a display monitor 21, headphone points 22, a PC power point 23, a cocktail table 24 and a reading light 25.

The display monitor 21 on which a passenger may watch in-flight movies and the like is pivotally connected to the housing 20 by a support arm 21a. The support 21a is rotatably hinged to the housing 20 and may be rotated to move the display screen 21 from a stored position shown in Figure 5a, in which the screen 21 fits snugly in a recess 21b in the housing 20, to a deployed position shown in Figure 5b, in which the screen faces the passenger in the seat. The display screen 21 is itself rotatably mounted to the support arm 21a and can be rotated about the axis of the support arm 21a thereby allowing the passenger to position the screen at a comfortable viewing angle depending on whether the passenger is sitting up or lying down. A rotatable latch 21c is provided to lock the display 21 in the stored position for take off and landing.

The cocktail table 24 is positioned above the support arm 21a to avoid drinks placed on the table 24 being spilt accidentally during adjustment of the position of the display 21. The cocktail table 24 is hinged to the housing 20 by a hinge connection 24a and is movable between a stored position in which the table 24 fits snugly in a recess 24b formed in the housing 20, as is shown in Figure 5c, and a deployed position in which the table 24 extends from the housing 20, as is shown in Figure 5a. A rotatable latch 24c is provided to latch the table 24 in the stored position. The headphone 22a and PC power points 23 are suitably positioned to minimize the risk of headphone and PC cables becoming tangled, when such devices are being used.

The reading light 25 is positioned on the top of the housing 20 and is arranged to direct light downwards towards the primary seat of the other seating unit.

Advantageously, access to the rear of an entertainment unit for maintenance or removal of the unit is achieved by unclipping the back portion of the housing of the adjacent seating unit and removing the back portion from its seating unit and the pallet on which the seating unit is placed. After a unit has been repaired or replaced the back portion is clipped back into place.

How a passenger chooses to configure his or her seat during normal flight is entirely up to the passenger and to this end, the primary seat is drivable between any position between upright and fully reclined. Furthermore, each seating unit also has a plurality of predetermined modes associated therewith into which the seating unit is automatically moved by use of a control pad. In each mode, the backrest 4 and the seat portion 8 of a seating unit are fixed at predetermined angles to the vertical and horizontal respectively, horizontal being defined by the plane of the cabin floor. Figures 6a to 6e each show the seating unit 2a in a different predetermined seating mode. For reasons of clarity, the trolley supporting the seating portion 8 of the seating unit 2a is not shown.

During take off and landing an aircraft is inclined at about 15° to the horizontal. If the seating units were designed so that the seating portion and the back portion were parallel with and perpendicular to the cabin floor respectfully, a passenger of a rearward facing seat would feel that during take off that he or she were slipping forward out of their seat. This is undesirable, because passengers would understandably find such a sensation uncomfortable.

In order to avoid such a problem, one of the modes in which a seating unit can be configured is a taxi, take off and landing (TTOL) mode which is shown in Figure 6a. In this TTOL mode, which passengers would be required

to adopt during taxiing, taking off or landing, the seat portion 8 is inclined at a predetermined angle to the horizontal, and the back portion 4 is inclined at a predetermined angle to the vertical to compensate for the take-off angle of the aircraft and thus leave a passenger feeling comfortable in his or her seat. Studies have shown that passengers find that having the backrest inclined at 30° to the vertical and the seat rest inclined at 15° to the horizontal is particularly comfortable and also acceptable for safety reasons. Preferably, each seat carries solenoid actuated shoot bolts (not shown) which mate with apertures in the seat guide tracks (not shown) to lock the seat in the TTOL position, thereby providing security for the passenger during taxiing, take of and landing.

During the course of a flight passengers will spend some time working and some time eating and drinking. One of the predetermined modes that the seats is designed to adopt is a working and eating mode which is shown in Figure 6b. In the working and eating mode, the back portion 4 is more upright than it is in the TTOL mode, and the seating portion 8 is less inclined to the horizontal than it is in the TTOL mode. This is necessary because passengers would find the orientation of the back and seat portions in the TTOL mode uncomfortable for working or eating in. Preferably, but not essentially, in the working and eating mode the backrest 8 is inclined at about 13° to the horizontal and the seating portion is inclined at about 4° to the horizontal.

Should passengers find their posture in the working and eating mode uncomfortable, there is also provided a less upright working and eating mode in which the seating unit 2a is shown in Figure 6c. In this mode, the back portion 8 is preferably inclined at about 20° to the vertical and the seat portion 4 is at inclined about 10° to the horizontal.

Figure 6d shows a seating unit 2a in a half reclined mode in which it is envisaged that a passenger can comfortably relax to watch in-flight

entertainment on the display monitor or to read. Preferably, in this mode, the back portion is inclined at about 25° to the vertical and the seat portion 8 at about 12° to the horizontal.

Figure 6e shows the seat 2a in a bed mode similar to that already shown in Figure 2a. In this mode, the primary seat 14 and the secondary unit 5 form a substantially flat surface.

Figures 7a to 7e of the accompanying drawings depict a secondary unit 50 which is shown in more detail than the secondary unit 5 shown in Figures 1 to 3. The secondary unit 50 comprises a pad 51 supported by a support member 52 which is anchored to a base part 53. The support member 52 comprises a first portion 52a which supports the pad 51 and a second portion 52b on which the first portion 52a is slidably mounted. The second portion 52b is securely attached to the base part 53.

In use, the pad may be raised and lowered to any position between the raised position shown in Figures 7a and 7b and the lowered position shown in Figure 7c. This is achieved by manually sliding the first portion 52a of the support member over the second portion 52b. Preferably, the secondary unit is configured so that if a predetermined minimum excessive force is exerted thereon, for instance three hundred pounds, then the unit is automatically lowered to the lowered position.

When in the upright position, the pad 51 can co-operate with a primary seat to form a flat surface, as is shown in Figure 2a.

The pad 51 is pivotally connected to the support 52a at a pivot 54. This allows the pad 51 to be pivoted between the horizontal position shown in Figure 7b and 7c and the vertical position shown in Figure 7d. It is envisaged that the pad 51 will be placed into the vertical position for take off and landings and also to allow passenger egress from a seat. In the vertical position, the footpad can be latched, to the back of the housing (not shown) of the next seat in front or to a bulkhead or other fixed structure within the cabin.

Figure 7e shows a plan view of the pad 51. The pad 51 is angled in shape to allow a passenger to place his or her legs on the cabin floor on each side of the pad. This allows the passenger to leave the seat without necessarily having to flip the pad into the stored position show in Figure 7d. This is possible because the front edge 55 of the pad 51 is wider than the back edge 56.

Preferably, the base part 53 is pivotally connected to the cabin floor at a pivot point 57. The whole of the secondary unit is rotatable about pivot point 57 for off centre rotation through 90° in the plane of the cabin floor. The rotation of the secondary unit in this plane allows a passenger more easily to change position in a seat during a flight. Full support of the passenger's legs on the secondary unit produces even pressure on the legs which in turn reduces circulation over a period of time. The rotation allows the passenger to avoid such discomfort as a "dead leg" feeling when getting up out of a seat.

Furthermore, this rotation about the point 57 allows the pad to be rotated from a position in which its front edge 51 faces towards the primary seat of the seating unit, to a position where its front edge 51 faces away from the primary seat. This is illustrated in Figure 8 of the drawings, where the front edge 61 of a secondary unit 60 faces a primary seat 63 and a secondary unit 64 has been rotated or swivelled through 90° so that its front edge 66 faces away from the primary seat 65.

When a primary seat is moved to a fully extended position, in order to form a bed with its secondary unit, it is preferable that the secondary unit is aligned with the primary seat so that the front edge of the unit faces the primary seat. In this configuration maximum support is given to the legs of a passenger. It would be inconvenient for a passenger to have to get up from a primary seat to correctly align the secondary unit each time a seating unit is put into the bed mode. Therefore, preferably each seating unit is arranged so that as the primary seat moves into bed mode, if the secondary unit is not

aligned with the primary seat, then, the secondary unit is automatically caused to swivel until the front edge of the unit faces the primary seat. One mechanism for achieving this is shown in Figure 9 of the accompanying drawings. Figure 9 shows a plan view of a seat portion 71 approaching a secondary unit 74 which is misaligned with the seat and has a pad 75 with a front edge 76 facing away from the seat.

The seat portion 70 is carried by a trolley 71 which runs in tracks 72a, 72b on the cabin floor. The trolley 71 has a pusher 73 extending therefrom which runs ahead of the trolley in the track 72a. The secondary unit 74 has a base 77 on which the pad 74 is supported by a support 78. The base 77 is pivotably mounted to the cabin floor at a pivot point 79. The base 77 of the secondary unit 74 is shaped so that as the seat portion 70 and the trolley 71 approach the unit 74, if the front edge 76 of the pad 75 is misaligned with the seat portion 70, the pusher 73 contacts the base 77 exerting a force thereon which causes the base 77 to swivel anti-clockwise about the pivot point 79 until, when the seat portion 70 reaches its fully extended position, the secondary unit 74 has been swivelled until its front edge 76 faces the seat portion 70.

Turning now to Figure 10 of the accompanying drawings, there is shown a partial cut away section of a secondary unit 80 including a mechanism for raising and lowering the secondary unit 80, between a fully upright position and a fully lowered position. The unit 80 comprises a first support 81 in the form of an elongate rod which is slidably mounted in a tube like second support 82. The first support 81 carries at one end a footpad, which for reasons of clarity is not shown, and at the other end is attached to a metal yoke 83. The second support 82 contains a pair of spaced apart upright supporting rods 84 each of which passes through a respective one of a pair of holes (not shown) formed in the yoke 83. The yoke 83 thus bridges the supporting rods 84 and the fit between each rod and hole is loose enough to

allow the yoke 84, and thus the first support 81 and the pad, to be slid between the fully raised position (shown in full lines) and the fully lowered position, (shown in broken lines).

The first support 81 and the yoke 83 can be locked at any position between the fully raised and fully lowered positions by means of a "mech lock" 85 attached to the yoke 83. The "mech lock" 85 is operated by an activating handle (not shown) fixed underneath the footpad (not shown), the handle being connected to the "mech lock" 85 via an operating cable 86. Preferably, the lock is configured to release if a force of three hundred pounds or more is applied to the unit. "Mech locks" are well known in the art and will not be discussed any further herein. Preferably, the first support 81 and the cable are surrounded by a protective casing (not shown), which shields the first support 81 and the cable 86 from view and which, as the first support 81 is raised and lowered, slides over the outer surface of the second support 82.

One possible cabin arrangement for the seating units described hereinabove shown in Figure 11. In this arrangement, pairs of seating units 1 are arranged in rows A, B, extending across the width of the cabin, and plural lines C, D, E, F along the length of the cabin. Each row comprises four pairs of seating units 1 extending across the width of the cabin. In Figure 9, only two rows A and B of pairs of seating units are illustrated although of course there would be many more rows on an actual aircraft. The first and second pair and the third and fourth pair in each row are separated by aisles 92, which provide access to the seating units and of course, allow passengers and attendants to walk up and down the cabin. Each of the seating units which is adjacent to an aisle faces towards the front of the cabin, whereas the non-aisle seats face towards the rear of the cabin.

Having thus described the present invention by reference to a preferred embodiment it is to be well understood that the embodiment in question is exemplary only and that modifications and variations such as will occur to those possessed of appropriate knowledge and skills may be made without departure

from the spirit and scope of the invention as set forth in the appended claims and equivalents thereof.

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